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FLUCTUATING FORAGE PRODUCTION

Its Significance in Proper Range and Livestock Management on Southwestern Ranges

BY J. L. LANTOW [1] AND E. L. FLORY [2]

SOUTHWESTERN ranges are subject to extreme climatic fluctuations. Precipitation in particular varies widely from year to year and month to month. Annual as well as seasonal fluctuations in weather are reflected in forage production, and have their direct bearing on time of use and grazing capacity of the range. Because of this, adjustments in livestock numbers, and in the time and degree of use, often become necessary to make the range use fit the fluctuations in production. Moreover, the time and degree of forage use should not penalize plant vigor or production, but should help to conserve soil and moisture. The desired or needed changes in management or in the number of livestock should be recognized early enough to permit the making of timely changes to benefit both land and operator. Although the operator should take advantage of high production years, he should follow with timely downward adjustments in numbers of livestock if such adjustments are found necessary to protect vegetation, the land, and his other assets.

Frequently in the Southwest a year of maximum precipitation will have 10 times more rainfall than that which falls in years of lowest precipitation. This is shown in figure 1. Several years of below-average precipitation may follow successively, and this often gives rise to a prolonged period of drought. Conversely, a period of several years above normal precipitation may precede or follow a drought period. Carrizozo, in central New Mexico, had an annual rainfall for the 22-year period, 1908 to 1929, inclusive, averaging slightly more than 9 inches. This was followed by a 10-year period averaging nearly twice as much. In every year of the 8-year period, 1926 to 1933 inclusive, precipitation was above the average of the previous 22 years (fig. 1). Records from Willcox, Ariz., show 14 consecutive years, 1891 to 1904 inclusive, with an annual rainfall materially below average (fig. 2) and followed by a period of heavy rainfall. It is particularly significant that during the last decade but few places recorded higher-than-average rainfall in the western United States. Willcox, Ariz., is one of a few western locations where average precipitation for the past 10 years was higher than for any previously recorded decade. At Morgan, Utah (fig. 3), in common with much of the West, precipitation during the past decade has averaged lower than any previous similar period.

Local storms may cover the same area repeatedly throughout a season and yet practically miss other areas. Such areas may be less than a township in extent; often on the same ranch a part may be well watered while the remainder suffers from drought. Monthly precipitation varies greatly at any given locality. Precipitation at Carrizozo, N. Mex., was found to vary from zero to more than the total annual for low years. Yearly and seasonal changes of management on a ranch are necessary for good livestock and range management.

In varying degrees the vegetation responds to climatic

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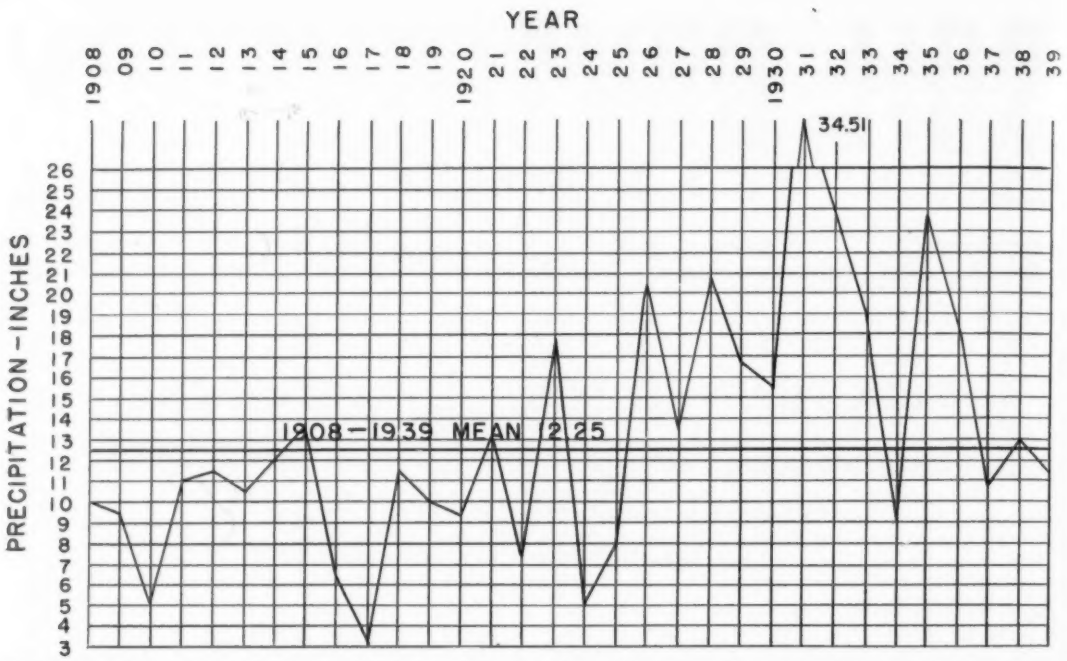

Figure 1.—*Annual precipitation, 1908–39, Carrizozo, N. Mex. Two general cycles, and important fluctuations within each, are to be noted: First, average or below; second, average or above.*

variations.—Soil moisture is the limiting factor to plant growth in the Southwest. Generally the amount of plant growth or forage production agrees rather closely with the amount of annual precipitation, but the character of precipitation, its seasonal distribution, and the vigor of the vegetation as influenced by the rainfall and use during preceding seasons, may influence forage production as much as does the total rainfall.

Records in central Utah where precipitation and forage production data were both available (fig. 4) show that the precipitation for any year did not vary more than 20 percent above or below the average for the period, but that during this same time forage production varied from 46 percent below average to 50 percent above average. Extreme as climatic fluctuations have been shown to be, forage production varies still more, and the departure from a recorded average may continue as long as there is a departure from the average in precipitation.

Severe drought results not only in little or no production of forage, but it may also decrease the grass stand. Generally there is a fluctuation in either composition or density of the vegetation in a series of years. Permanent injury may be caused by drought on an overgrazed range, but on a properly used range, even though material reduction in density may take place during drought, recovery of stand is rapid with increased precipitation. The drought-thinned stand on a properly used range will produce a high forage yield upon return of favorable climatic conditions, even before recovery of the stand, because of the large volume growth of vigorous grass plants with little competition.

Forage use is a limiting factor in forage and livestock production.—Forage production may be reduced greatly by the climate, but it may be affected or its reduction accentuated still more by overuse. Forage production at Willcox, Ariz., and Carrizozo, N. Mex., in common with most of the West, has been low during the past decade although the precipitation has been relatively high. As in other locations, this has been laid to drought which has been general. However, the precipitation at these two locations has been above average for the past decade. Decline in forage production was due largely to overuse.

Density of black grama decreased in some New Mexico areas (*8*)[3] as much as 89 percent in a single year of drought. During 1934, in western Kansas, 74.8 percent of short grass plants were killed on overgrazed pastures, and 64.6 percent on those moderately grazed (*9*). During the same year, in Arizona, grass density declined 70 percent on lightly used pastures, but was completely eliminated on heavily

[3] Italic numbers in parentheses refer to publications listed at the end of the article.

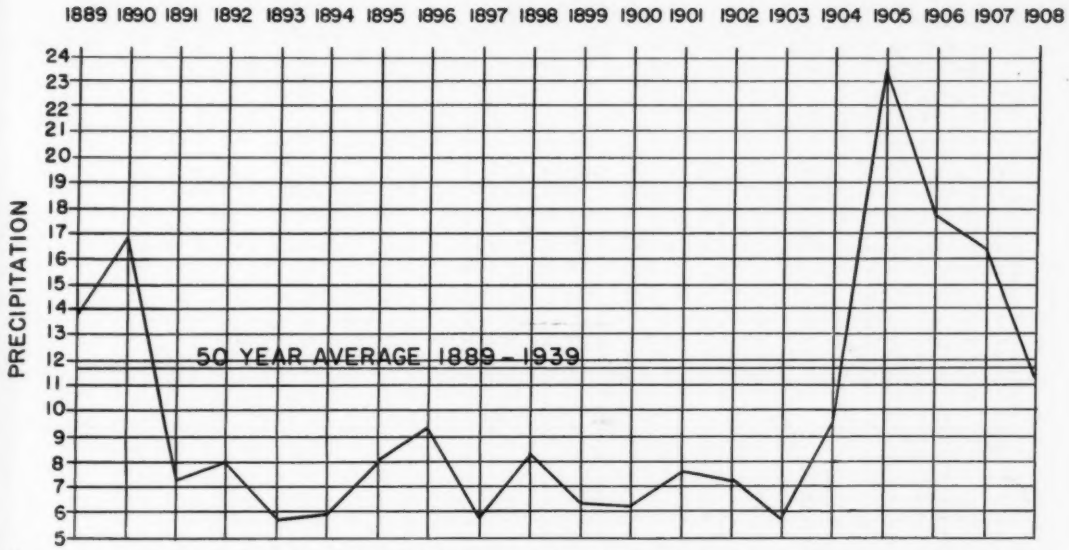

Figure 2.—*Annual precipitation, 1889–1908, Willcox, Ariz. Two periods of more than average precipitation occurred within the 14-year period of drought.*

grazed ones (4). Continuous close removal of the food-manufacturing leaves of the grass plant so starves it and uses up its reserve food that finally the plant's root system is shortened and its size and vigor reduced. Grama grass plants, weakened to the extent shown at the right in figure 5, may succumb in severe droughts. The ranges from which a large part of the grass stand disappeared in 1934 were populated by such weakened grass plants.

In Idaho it was observed during the period 1924–32 that forage fluctuated, under heavy and continuous spring and late fall grazing, in accord with favorable and unfavorable growing conditions the first two years, but the productivity of the pastures declined consistently thereafter in spite of some very favorable years. At the end of the experiment a reduction of 20 to 65 percent in grazing value was measurable (2).

It has been shown experimentally in some localities that the grazing of black grama to 2 inches will reduce the forage yield by one-half in 3 or 4 years and practically to zero in 8 or 9 years. Tobosa, clipped to 4 inches, yielded 110 percent more total forage in the 11-year period, 1924–35, than that clipped to 2 inches; vigor and stand were reduced on the 2-inch clipping so that the 4-inch clippings yielded 11 times more forage during the last 4 years of the experiment than the shorter clipped plots (1).

All parts of the grass plant—roots, stems, and leaves—play an important part in soil and water conservation. Recent work indicates, however, that volume growth of top parts has a much greater effect than does vegetal density in reducing run-off and increasing percolation of water into the soil. Also, it is indicated that volume growth of plant tops and vegetal debris on the soil surface have a greater effect in reducing run-off and increasing percolation of water into the soil than do the combined effects of degree of slope, previous moisture content of the soil, and rate of precipitation (3).

The limitation of use of forage by livestock for a properly managed range therefore may be considered to be the time and degree of use beyond which plant vigor is penalized, run-off and erosion induced, percolation of water lessened and, as a result of the foregoing, forage production materially reduced.

Overuse of range penalizes not only forage production but the returns from livestock as well. Although range forage is fresh or cured feed stored on the ground, it represents as definite an amount of feed as hay stored in a stack. If too many livestock are grazed on it, there may be little more than enough for maintenance, whereas there ought to be sufficient feed for each animal to maintain itself as well as additional feed to be accounted for in either increased body weight or weight in calf or lamb production.

On semiarid grassland areas of light forage production capacity, having only 8.5 inches annual precipitation, good management that provided for plant vigor and plenty of forage (full feed) for the cattle has been producing 1,000-pound cows, with a 90-percent calf crop, the calves weighing 400 to 450 pounds at 7 to 8 months of age (7).

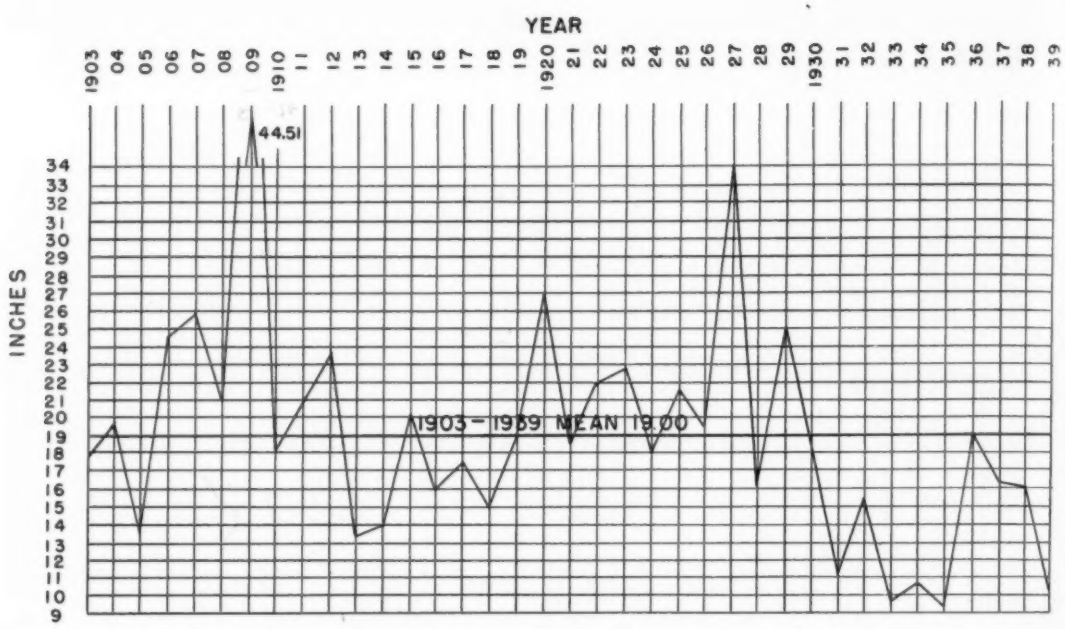

Figure 3.—*Annual precipitation, 1903–39, Morgan, Utah. Observe the periods of fluctuating rainfall, particularly the low precipitation of the last decade.*

Cows receiving 30 percent less feed, on poorly managed ranges, reach a mature weight of only 750 pounds with a 50-percent calf crop, the calves weighing only 320 pounds at 7 to 8 months (6).

On a straight poundage basis, in the first case, 1,000 pounds are being maintained for 360 to 400 pounds of calf. Approximately 73 percent of the feed is being used for maintenance. In the case of the 750-pound cows, with a 50-percent calf crop, 1,000 pounds are being maintained for 203 pounds of calf, and 84 percent of the feed is being used for maintenance.

The importance of good breeding is well known, but the mature weight of range cows and their productivity is influenced more by feed than by breeding. Well-managed ranges with plenty of feed are producing heavy cows and big crops of heavy calves. Overgrazed ranges with a shortage of feed are producing light cows and small crops of light calves regardless of how well bred the stock may be.

The objectives in range forage management are fivefold.—Proper range forage management is determined by the amount of grass growth or other forage that should be left on the ground to (1) conserve soil and moisture, (2) maintain plant vigor, (3) help in restoring a desirable vegetative cover on depleted and denuded ranges, (4) maintain an effective stand on range in good condition, and (5) maintain maximum forage production which in turn results in maximum livestock production.

No specific procedure for making adjustments in forage use can be given to fit all parts of the country, or even different ranches within a given area. A few general principles, however, should be applied universally in range livestock management, such as (1) timely adjustments, (2) "full feed" on range from a range forage standpoint, (3) recognizing the opportunity of taking advantage of forage variations by livestock adjustments, and (4) providing the reserve feed that is necessary and sufficient to carry the livestock until the next regular shipping season, thus cushioning the effect of a possible delay in new growth or periods below normal production. Range-utilization and forage-production checks (5) are being used in the Southwest Region to guide the application of these range and livestock management principles.

Range-utilization and forage-production checks involve considerable planning as to methods and time and variations as to local conditions.—These checks will vary as to time and somewhat as to manner of application in different parts of the country. It has been found, however, that field men are able to make great progress in teaching the recognition and soundness of timely adjustments when forage production varies to the extent that sound economics and the objectives of soil conservation cannot be reached with the con-

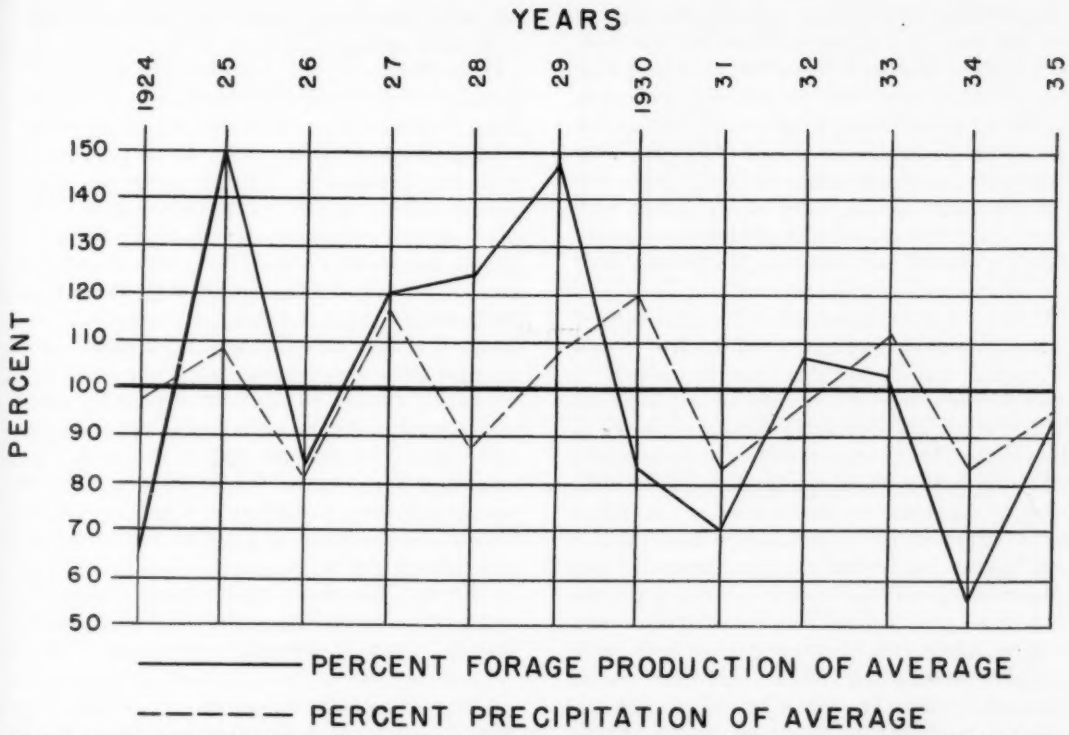

Figure 4.—Forage production and annual precipitation; annual deviation from average for period 1924–35. Forage production is seen to fluctuate between wider limits than precipitation. (The Western Range; Senate Doc. 199, p. 144; Weather Bureau records.)

tinuance of a set number of livestock or a prescribed plan of use.

Two checks should be made on most ranges, one in the fall and the other at the beginning of the growing season. However, one check may suffice or be more desirable, depending on whether the ranges are year-long or seasonal. The key time for taking stock of forage and feed resources is generally in the fall of the year after the growing season. At that time an analysis can be made of the approximate percent of forage that has been used during the summer months and the amount of forage still available. This feed may be not only the forage on the ground, but also that which is harvested, such as hay or ensilage. If it is apparent that the holding of the present number of stock will use up not only all the growth of the most palatable species but also some of the less palatable ones, and that such use will definitely damage the range, adjustments should be made immediately, either by securing more feed or by reducing the number of livestock in accordance with the available feed.

On ranges that have been used seasonally, it is well to make an analysis of the degree of past use and compare it with the records of stocking to help in planning future management. The fall check on year-long ranges is valuable in a similar manner for analyzing effects of use to date and in projecting or planning needed management adjustments.

A second check at the beginning of growth on year-long ranges will supplement the fall check and further aid in adjusting management to conform to proper use. Additional casual but frequent inspections of pastures, livestock, and condition of the entire ranch are essential to successful livestock and range management, just as they are essential in any business. Many things can happen to vary conditions considerably, and one should be on hand to recognize and grasp the significance of such changes.

Stockmen are accustomed to work with these three elements: *time; numbers of livestock; percentage of feed used or left in the management of their ranges.* These factors should be considered when utilization and production checks are made. Where the Soil Conservation Service is assisting the operators to bring about better land use, Service range men should cooperate with ranchmen in making forage utilization and production checks, since joint participation will result in better understanding and accomplishment.

Livestock men always have made adjustments, but generally downward adjustments have not been made soon enough. The fact that numbers of livestock have been carried at a given level does not mean that a sacrifice has not been taken on weight or other production during low forage production years. On the other hand, when there has been increased forage production over any period of time, it has generally been used. Thus, the downward livestock adjustments were not drastic enough or made soon enough to protect either the livestock or the forage resources.

It is believed that needed or desirable adjustments in livestock numbers in a large part of the West should be made in the fall, and that corrections should be made to extend until the next regular shipping time. This does not mean necessarily that each pasture will have left on it an equal amount of feed; it means instead that some rotation or arrangement should be followed whereby dependence for feed is based on stored feed, or on old growth on the ground even though it is of poor quality, rather than on a problematical forage growth which may be delayed. A selling program may be followed if found desirable, although if livestock is held until the fall shipping it may be advisable to add supplements, especially if available forage is old and unpalatable. The extent of such changes and adjustments depend, of course, on locality and the type of operation.

Checking is necessary to supplement the grazing capacity estimate.—Proper management of ranges, as before stated, is dependent upon maintaining livestock on full feed, maintaining forage production at a high level, and conserving soil and moisture resources. It has been the practice to advocate that these objectives be attained by stocking ranges at a sustained grazing capacity. This sustained grazing capacity is set by some agencies at various percentages below the average forage production of the range as determined by range surveys. But this average forage production is very difficult to establish with any degree of certainty, and, if correct, might not be the best figure to use as a base for any given year.

Grazing capacity arrived at by a survey represents an estimated average and is valuable as an indication of relative grazing values over different parts of the range, or of one range with another. Owing to fluctuation in forage production, it must be recognized that for any given year the actual stocking may vary above or below the average grazing capacity estimates. No change in stocking for the ranch as a whole need be made, however, if, within reasonable limits of error, the estimated usable forage at the end of the forage production period will support the number of animal units being carried.

In the Southwest, high densities of weakened blue grama stands are commonly encountered on overused ranges. Heavy use has shortened and restricted the root systems and the size of the grama grass plants until they do not utilize all the growth factors of the habitat. Thus, invasion of the intervening spaces by other species is possible, or by additional grama plants, largely by division, but these also remain small and weak due to overuse and competition. Such ranges make very little growth under the most favorable climatic conditions, and when proper use is initiated years are required before the density is sufficiently reduced by death of the weaker grama plants to allow the original cover to increase in size and vigor. Not until this stage is reached is there possibility of appreciable volume growth. Some exclusion plots began to show such changes and response within 3 years; others have had no use for 6 years and the only change yet apparent is a slight decrease in density. The vigor of the remaining plants has not recovered sufficiently for an increase in volume growth. Generally some use of grass is preferable to no use, but recovery of some such ranges may be slower with use than with nonuse. While this condition is most apparent on blue grama grass ranges, the same condition also is true of many other grass types.

When density, palatability and composition have been accurately determined, it has been found in one instance[4] that a forage acre requirement determined under actual use and climatic conditions should have been as much as three or four times greater because of the inability of the grass stand to produce volume growth. In this instance an adequate cut had not been made for low vigor in first arriving at the forage acre requirement.

The number of forage acres may vary considerably in different years on the same range, and under the present method of surveys it is difficult to know how far an established figure of forage acres has departed from an average. For example, stocking on a grazing capacity estimate made 10 years ago at Carrizozo would have resulted in unused feed during the past 10 years. However, there would have been some advantage to soil conservation. It was determined experimentally upon range land not far from Carrizozo that actual grazing capacity based on yearly forage production varied from a high of 3,102 animal units in 1915 to a low of 738 in 1934, the average being 1,900 animal units. The variations in percent were 63 above and

[4] Test made in collaboration with other agencies under approved methods of establishing forage acre requirement in such types.

61 below. Also, past use records may have been taken for a period that was either above or below the average grazing capacity.

In another instance (Morgan, Utah), the average annual precipitation for the decade 1920–29 inclusive was 22.34 inches. During the past decade, 1930–39 inclusive, it was 40 percent lower, 13.55 inches. Had the ranges been stocked on a "sustained grazing capacity" to the extent of 40 percent below the "average carrying capacity" as determined by a range survey in 1929, there still would have been too many livestock and probably permanent injury to the ranges, since the average precipitation for the 5-year period, 1931–35, was 50 percent below that of the preceding decade.

After harvest, the farmer who feeds livestock counts his tons of hay, ensilage, corn, or whatever feed he has produced and makes his plans until the next harvest accordingly. If he has a bumper crop, he will feed more stock for a longer period and carry over a little reserve feed beyond the next harvest season as provision for a possible low-production year. In the event of a poor crop, he should reduce his livestock to fit the available feed. The many successful ranchers who operate on the basis of adequate feed reserves on the ground to carry their livestock to the next regular selling period, without depending on a new growth which may be late or not materialize at all, are following the same general principles.

Since range experiences and investigations have shown that forage production varies widely, and that livestock adjustments need to be made often, the following possible adjustments are suggested:

1. Sell early enough to assure sufficient feed to carry over a substantial portion of the breeding herd. One-fourth of a total 50-percent reduction can be accomplished by selling certain classes of livestock 6 weeks early.

2. Sell cattle whose meat value is near their true value, such as steers, yearling heifers, calves of acceptable market age, fat dry cows.

3. Sell weaned calves, old, crippled, and excessively thin cows, all of which would be unduly expensive to carry over.

4. Sell heifer calves and yearling heifers that would not contribute to the building up of the quality of the herd.

5. Sell inferior breeding cows, shy breeding cows, and old cows expensive to carry over, and of little or no value.

Reductions such as these, in accordance with the degree of necessity and urgency, generally can be made

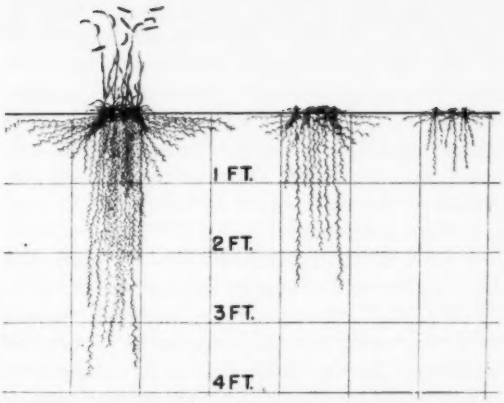

Figure 5.—*Root and top development of blue grama grass resulting from different degrees and methods of past use. Left, plant in full vigor, full forage production; middle, low vigor, low forage production; right, depleted vigor, no production.*

in cattle [3] numbers to fit years of low forage production with a minimum disturbance of the basic breeding herd, and with maximum protection to the rancher's income and economic stability.

Applying the above principles to reduction on a 100-cow ranch with 5 bulls, 20 or more heifer calves, and approximately the same number of 2-year-old heifers kept for replacements, where the calf crop is 80 percent, death loss of breeding cows 2 percent, culling of long yearling heifers 10 percent, culling of cows for unsoundness and nonbreeding 2 percent, and with sale of old cows at 9 years of age, a 50-percent reduction can be made in the total number of animal units, leaving intact approximately two-thirds of the normal cow herd consisting of the very best of cows from 3 to 6 years of age.

Under the same conditions on a ranch where most of the steer calves ordinarily are carried over and sold as yearlings, a 50-percent reduction can be made in the total number of animal units by disposing of the classes of stock mentioned above, thus leaving intact approximately 75 percent of the normal cow herd consisting of the very best cows from 3 to 6 years of age.

Diligence in taking forage inventory in low production years and in making sales promptly usually will preclude greater reductions than shown in the two preceding examples. In years of extremely low forage production, it may be necessary to make still further reductions in the breeding herd although this rarely will be necessary if management is projected ahead by timely adjustments. In the case of adjustments that

[3] Cattle have been used throughout this paper to illustrate principles. Other kinds of livestock may be handled with limitations peculiar to the kind, according to the same principles.

are delayed until all feed is used in the hope that the stock will live through, the outcome may be the sacrifice of a very large part of the breeding herd at a ruinous price, in addition to the total loss of many through starvation, and a serious handicap to future forage production by overuse. Under proper management, involving timely adjustment to fit forage production, adjustments need not be frequent and are much less disastrous.

In years of high forage production the numbers of livestock may be increased by keeping the steer calves another year, and, if necessary, increasing the cow herd by retaining more heifers or buying. Generally, steers may be kept with extra profit; it has been demonstrated by tests under Southwestern semiarid range conditions that a given pasture will produce more on a yearling-steer basis than with a breeding herd on a cow-and-calf basis.

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NATIVE PLANTS STABILIZE POND SHORES

BY BEN OSBORN[1]

BY PROTECTING native plants around a pond, the Service and a cooperating farmer, in three seasons, succeeded in completely stabilizing the shores and inlet channel. Now neither waves nor inflowing water can pick up soil and carry it into the pond. At the same time, nesting sites were created for birds and also a suitable stopping place for migrating ducks. A fence constructed around the pond at the time it was built excluded livestock and made possible the establishment and development of the vegetation.

The dam was built with emergency drought-relief funds in the late summer of 1936. The site was a draw through a native prairie pasture on the farm of E. R. Sherwin, near Elk City, Okla. At that time the

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Amphibious herbs at water's edge at upper end of pond, with willow, buttonbush, and sloughgrass beyond.

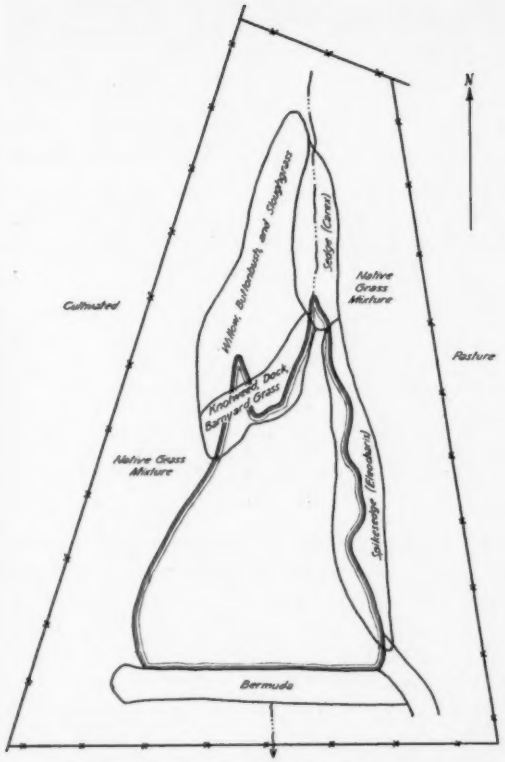

Diagram of vegetation around pond.

cover was badly exhausted by months of drought and continued use by hungry livestock.

The dam and spillway were sodded to Bermuda grass in the fall following the construction. With livestock excluded from the shores, natural vegetation was promptly established on the rest of the enclosed area. Various kinds of native herbaceous and woody vegetation, each in its normal relationship to the water, soon covered the area within the influence of the impounded water. The rest of the fenced area grew up to a mixture of native grasses, including switchgrass (*Panicum virgatum*), little bluestem (*Andropogon scoparius*), sideoats grama (*Bouteloua curtipendula*) and blue grama (*Bouteloua gracilis*).

By the fall of 1939 a native species of sedge (*Carex*) had formed a perfect mat of vegetation in the inlet channel to the pond. This cover was capable of carrying without damage the inrush of water during the occasional torrential rains characteristic of the plains country. A mixture of willow (*Salix*), buttonbush (*Cephalanthus*), and sloughgrass (*Spartina pectinata*), grew on the low-lying ground at the upper end of the pond. Within the zone of usual fluctuation of the normal water line, and in the shelter of the taller vegetation, a mixture of amphibious herbs, principally knotweed (*Polygonum*), dock (*Rumex*), and barnyardgrass (*Echinochloa crus-galli*), became established.

One side of the pond site was a gentle slope that allowed for a wide lateral fluctuation in water line. A species of spike sedge (*Eleocharis*), capable of withstanding occasional inundations as well as long periods of exposure, developed here. It completely covered this critical shoreline, reaching from below the water's edge to the grass cover above the high-water line. The slope of the other side of the pond was abrupt, and the native grasses grew down to the water's edge.

In the summer of 1940 the vegetation around this pond already was being used as a nesting place by birds. Redwing blackbirds occupied the shrubs and tall sloughgrass cover at the upper end of the pond. Meadowlarks nested in the grass around the pond. Mourning doves used it as a watering place, and killdeers, Arkansas kingbirds, scissortailed flycatchers, grackles, and other birds were regularly present during the summer.

The only vegetation established by man at this pond site was Bermuda grass. The other vegetation was established naturally, a process which ordinarily will be duplicated in the Oklahoma prairie area wherever similar protection is given.

P. E. Neale, of the New Mexico Experiment Station, reported that two groups of range cows, of 78 and 116 head, respectively, had equal quantities of feed. The group of 78 cows, having an average ration of 21 pounds of feed, produced 28,000 pounds of calves, while the group of 116 cows, given an average ration of 14.3 pounds of feed, produced only 9,000 pounds of calves. In the case of the group of 78 cows, there was a 90-percent calf crop and the gross return per cow was $28, while in the group of 116 cows there was a 30-percent calf crop and the gross return was $6 per cow. It is very apparent that range cows must have practically full feed of the forage commonly produced on the range in order to produce a big crop of good calves at weaning time.

Indians of other days were largely responsible for the great grassland plains of the Southwest, according to W. G. McGinnies, ecologist for the Southwestern Range and Experiment Station at Tucson, Ariz. The early American red men, afoot and unable to catch the fleet game of the plains country, used the device of setting fire to the grass to drive the animals into the woods where they could be stalked with more success. Had it not been for these fires, much of what are now grasslands would be covered with forests.

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FIVE YEARS OF TREE PLANTING IN THE OHIO VALLEY

BY J. A. GIBBS [1]

DURING the last 6 years the Soil Conservation Service has replanned for erosion control more than 8,000 farms in the Ohio Valley Region. On most of these farms small woodland plantings have been established. The observations reported in this article are based on the planting of many millions of seedlings and transplants, and the practice of direct seeding under widely varied conditions.

What are the results? Have these new tree plantations survived? What species of trees are the best? Has erosion been controlled? Can other farmers successfully reclaim eroded areas on their farms by planting trees?

After five full growing seasons—together with the results of forestry research—some of these questions can be answered, and the follow-up observations of the erosion-control demonstrations permit certain recommendations. A wide range of species, methods of planting and of site treatment have been tested and observed.

A study of a great many of the adapted plantings and methods points out very forcibly the importance of the principle of "minimum requirements," the chief concern of the average farmer in approaching his tree planting problems. He very logically wants to know and needs to know what are the simplest and lowest cost requirements necessary and adequate for his particular area and set of conditions, to bring about the desired results within a reasonable length of time.

Early erosion-control plantings consisted chiefly of black locust. This was due to a partially mistaken belief that black locust would thrive under any conditions and, also, to the relative ease of providing ample planting stock. In the 1935–36 plantings, 79 percent of all trees planted in the Ohio Valley Region (Michigan, Ohio, Indiana, Kentucky, and Tennessee) of the Soil Conservation Service were black locust, 13 percent were other hardwoods, and 8 percent were pine. In general, seedlings and transplants were used, although a small amount of direct seeding was done also.

Since that time however, a gradual change has been brought about in the ratio of black locust to pine and hardwood species. In sharp contrast to 79-percent locust and 8-percent pine planted in 1935–36, only 35 percent of the trees planted in 1938–39 were locust and 52 percent were pine. There also has been a decided trend away from so much gully planting. Instead, more and more of the planting has been done on eroded fields as may be noted in the following table:

Table showing trend of tree plantings, 1934–39

Plantings	1934–35	1935–36	1936–37	1937–38	1938–39
	Percent	Percent	Percent	Percent	Percent
Black locust	83	79	60	42	35
Pine	14	8	13	27	52
Hardwoods	3	13	27	31	13
On fields	21	29	63	71	86
In gullies	79	71	37	29	14

In establishing most of the earlier stands the grub hoe for scalping and the center hole method of planting were used in fields. In planting gullies, banks were sloped and check dams of varying types were put in. Fertilizing of black locust, particularly in Indiana, and also mulching were employed in some locations. Contour furrowing and ridging were used in 1937 and 1938.

On some sites contour furrows and ridges proved advantageous in facilitating planting and in checking erosion, but the variable results do not justify general recommendation of this method of site preparation. Under certain conditions the furrows filled up completely within a period of 2 or 3 months, while on other sites heavy vegetation developed between the furrows when the areas were protected from grazing and this greatly minimized the water-conserving benefit of the furrows. On certain soils, too, the furrows and ridges have not served to stimulate growth. Low cost fertilizing of individual trees has given good results on some soils, especially in Indiana, and the practice is now being tried in other parts of the region. A tablespoonful of fertilizer per tree applied to black locust at the time of planting stimulates initial growth of backward trees.

In view of both costs and results obtainable, there appears to be little justification for the sloping of gully banks in tree planting areas intended for permanent woodland. In the Ohio Valley plantings, the trees have survived and grown well on very steep unsloped banks. Encouraging results also have been obtained from plantings above and below vertical gully banks. Obviously, we may expect that stabilization will be

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Loblolly pine planted as 1-year-old seedlings in 1934 on Atwood fine sandy loam Before planting the area was plowed; lespedeza was sown. This fine survival has attained a maximum height of 13 feet.

delayed where the banks are not sloped; but on the other hand the average farmer can better afford to wait for desired results than to make the outlay for sloping operations.

Live check dams formed by planting rows of trees a few inches apart across the bottom of gullies have been effective. Wider use of readily available, local, adaptable species of both trees and shrubs can be recommended for this method of stabilization. Pine, black locust, and willow were originally used in living check dams; more recently, however, there has been a trend toward using almost any native, readily available plants such as buck brush, broomsedge, blackberry, etc. The use of both the trees and shrubs represents very little labor or other cost. The usual method of establishment is by planting two rows of plants in a prepared "shovel-wide" trench across the bottom of the gully. The plants are spaced 3 to 8 inches apart in the row. On the basis of the costs and the benefits derived from mechanical check dams (stone masonry, concrete, wood slab, wire, etc.) such structures cannot be justified for gully control in tree planting areas.

Mulching of gully heads and other critical and poor sites has produced results that seem to justify broader application of this practice where mulching material can be obtained close at hand. Material such as broomsedge lifted with the roots, straw, and fine brush have proved very effective. Mulching has been observed to stimulate both survival and growth and also the occurrence of volunteer vegetation. Mulching also lowers surface temperatures: In western Kentucky, during August afternoons, soil temperatures of the top half-inch of Grenada soil ranged as high as 140° F. on unmulched areas of southern exposures—this in contrast to not over 90° F. on comparable mulched areas.

Observations covering a wide range of soil conditions and common species show that soil types and soil conditions constitute the first and most important consideration relative to a decision as to what and how to plant. Proper correlation of species and sites largely accomplishes satisfactory establishment and growth, at minimum cost. In the 5 years of tree planting there was much evidence to indicate that where the proper species had been used for the site involved, very little site treatment was required aside from protection. Likewise, where the wrong species had been used, elaborate site preparation had not stimulated growth.

The results of these plantings indicate that direct seeding of light-seeded hardwoods offers considerable promise of satisfactory establishment under favorable soil and site conditions. Direct seeding of such species as black walnut has not been encouraging, chiefly because of removal of the seed by rodents; but on the other hand good results with other species, using this low-cost, simple practice, point out the importance of continued effort toward solving the rodent problem. The practice of stratifying such seed as walnut and oak, followed by spring planting, minimizes loss by rodents. Observations seem to verify the opinion of many that there are several distinct advantages in using the seed instead of seedlings of such taprooted species as black walnut. Among other difficulties in connection with the use of seedlings, some root rot has been found to occur in the heavy taproot where it was severed in lifting operations. With black walnut seedlings, producing taproots as long as 50 inches the first year, it is hardly to be expected that more than a

small part of this root will be preserved in lifting. In using light-seeded species, such as tulip and ash, broadcast seeding is considered preferable to seeding in prepared spots, as it results in better distribution. For the average farmer there need be no cost for direct seeding, provided, of course, he is able to collect desirable seed on his or neighboring farms.

In the treatment of the old established but neglected woodland areas, protection from livestock has been the first essential measure throughout the five years of the Ohio Valley plantings. This protection alone with no additional treatment or planting, has resulted in the appearance of literally thousands of woody plant seedlings per acre within a period of 2 to 5 years. This represents the simplest, the least expensive, and generally the best method of reestablishing an effective and profitable cover in old woods. Observations over the past 5 years indicate that under many conditions, protection and the presence of seed trees are sufficient to bring about natural reproduction and reestablishment of a satisfactory stand. The farmer and the forester in the Ohio Valley are both alert for these favorable conditions—conditions which if present will eliminate the necessity of costly and hazardous tree planting.

There are many areas, however, where the original soil conditions, which once supported native hardwoods and would now be favorable for natural reseeding, have been completely changed as the result of erosion. These areas are characterized by serious sheet erosion and all too commonly by gullies. Under such conditions, artificial establishment of cover becomes advisable in order to provide an effective stand for erosion control and to afford economic benefits. The chief problem on such areas has been what species to plant, since in the first place, these eroded lands include a wide range of soil and site conditions, and second, because it is desirable to bring about the best results in the shortest period of time.

Abundant evidence indicates the importance of using pioneer species on eroded soils. Hardwood plantings, including black walnut, tulip poplar, ash, maple, red and white and black oak, in all instances have failed to develop on eroded soils. While black locust often makes satisfactory growth under a wide range of soil conditions, consistent failures on some soils indicate the need for cautious selection of sites. Black locust has done particularly well on soils containing some calcareous material (lime) in the parent material; it has been found making remarkable growth in such soils as Princeton sand in Indiana, and in Brooke and Upshur soils in Ohio in both gully and field plantings. Failures have been observed on some soils where relatively high iron and manganese concentrations were present. As an example, a 5-year-old plantation was classed as a failure on a Muskingum silt loam soil with purple shale parent material where the manganese content was found to be very high and where limestone was absent. Failures have occurred also on some of the cherty and coastal plains soils in Indiana, Kentucky, and Tennessee, both with and without elaborate site preparation. In one area in central Kentucky where cherty soils are commonly found in tree planting areas, failures of black locust are common.

In height growth, black locust has made up to an average of 4 feet per year over a 5-year period on the better locust sites. Over the same period, the most rapid growth of pine was found in western Tennessee where loblolly pine averaged about 2 feet per year. Of the northern pines, red and Scotch have excelled in height growth. Actual measurements of several 5-year-old plantations on one project in Ohio (Muskingum County) show an average total height of 4.7 feet for Scotch pine, 3.9 feet for red pine, and 3.4 feet for white pine.

Even though there are fewer pine plantations in which to check results, it is evident that generally they are more successful on eroded soils than black locust. Many successful pine plantings were observed on sites where black locust has failed.

Ordinarily a good ground cover of weeds, grasses, and woody seedlings was established in all plantations of 5 and 6 years of age. Under the black locust, considerable variation in the characteristics of ground cover was in evidence and in the more successful plantations either a leaf litter or bluegrass cover, or both, had accumulated. Natural reproduction of woody species was taking place in most of the locust plantations where observations were made; in 40 out of 55 five-year-old plantations studied, there was natural reproduction consisting mostly of such species as sassafras, black gum, dogwood, cherry, sycamore, soft maple, elm, and a few species such as red, black, and white oak, tulip, ash, and hickory. It was significant that where black locust had failed there was little, if any, ground cover.

With the exception of loblolly pine plantations in western Tennessee, no great amount of litter accumulation was found under 5-year-old pine plantations. In most instances, however, such plants as broomsedge, poverty grass and blackberry were found between the pine trees. The loblolly was the only species of pine that had begun to close and exclude the grasses and shrubs.

One of the major considerations in observing ground cover was to check the effect of plantings on erosion. In most of the areas observed, erosion had been checked materially by the combined effect of planted trees and the native volunteer vegetation—this was especially true where the trees had grown well. Although usually gully banks were completely stabilized in the course of 4 to 6 years, gully bottoms in some soil types were still active in varying degrees.

Aside from improper selection of species for sites involved, the most common cause of the failures observed was grazing. A strikingly large percentage of the older plantings are not being protected from livestock; hogs, sheep, and cattle are gradually destroying many plantings where once were good survival and growth. Plantings were noted where trees had been almost completely destroyed by the browsing, rubbing, and trampling of livestock. Unquestionably, the most vital need in a farm forestry program in the Ohio Valley Region is an educational campaign to demonstrate to farmers the damage to young trees, both planted and native, from grazing by livestock.

FARM WOODLAND—FARM ECONOMY

BY JOHN F. PRESTON [1]

SOIL conservation districts represent an attempt to provide the social machinery by which a democracy can save the soil resources essential to the continued existence of civilization. There are many reasons of self-interest for adopting soil-conserving practices, and many more that are largely community and national interests. The farm planner must appeal to both the inherent individualism dominant in all men and to the larger instincts of the common good. Since the parts of the farm dedicated to permanent use as woodland vary all the way from badly eroded land in need of reforestation to good producing forests capable of bringing in an immediate income, their successful incorporation into the farm organization involves the ideas of self-interest and profit and those of community and national welfare.

For example, let us consider national wood economics. We have about 140 million acres of potentially productive farm woodlands. If this potentiality could be converted into reality these forests could produce annually all the lumber used in the United States on the basis of averages for the past 10 years. This would be about one-third of our total wood requirements. This would mean cheaper lumber than consumers are getting now, and the income going to the farmer-producers would go a long way toward solving the problem of farm income on millions of farms. Perhaps farm woodlands should not be managed primarily for sawlogs, but the example cited serves to illustrate the point that both national interest and individual interest point to the wisdom of growing perhaps one-third of our national wood requirements in the form of poles, posts, pulpwood, sawlogs, and other products on farm.

To bring this about requires a change in farmers' ideas of farm economy. It means acceptance of the idea of a productive woods managed as a part of the farm where a wood harvest in winter becomes as much a part of a farm calendar as a hay harvest in summer. Temporarily, such a change involves problems of marketing which will not exist when sustained-yield management becomes general. The marketing problem is acute largely because we have such an abundance of low-grade products, such as fuel wood, and a scarcity of high-grade products, such as poles and sawlogs. Wood-using industries have been forced, because of inability to buy suitable wood products from farmers, to seek other sources of supply and often to move out of agricultural sections. When good management practices on farm woodlands produce the products required by industries, in sufficient quantity to supply their annual requirements, there will be little difficulty in finding a market; wood-using industries will spring up where raw material can be obtained at satisfactory prices. Our present difficulty is concerned with the marketing of low-grade products, but the real problem is to produce high-class timber that will attract its own market.

At the other end of the economic scale are the lands dedicated to woodland use which are now producing nothing and may constitute erosion hazards. These may be worn-out fields with little or no cover, or logged-off land with only a brush cover. The self-interest of the farmer will prompt him to make such lands productive, provided he can see a reward for his efforts.

What is involved in the rehabilitation of such lands? Usually fire protection, nongrazing, planting stock, labor of planting, and sometimes cutting of brush, mulching, or other means of preparing the planting site, and perhaps weeding operations as the trees

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grow. Planting stock may be furnished free or at nominal prices by public or private agencies, or the stock can be grown on the farm. The nongrazing of such areas may entail some sacrifices of income, and some cash expenditures for fencing. The preponderance of weight in the list of things to be done, however, falls in the class of labor to be expended on the land. This is the farmer's stock in trade. It is what he markets when he sells grain or hay or livestock or wood products. Often he fails to get a fair labor return; rarely does he get a profit over and above labor. Much labor is expended on farms that does not promise an immediate return—for example, planting an orchard or a hedge row, mowing the lawn, growing flowers, painting the buildings, whitewashing the fence and tidying up the place. In the same category come numerous farm activities sponsored by the county agents and farm organizations. Perhaps more unproductive labor has been expended on clearing land inherently not suitable for clean cultivation than on most other farm activities. Restoring land to productivity brings its own rewards in future income, in increased capital values and in the satisfaction that comes from a job well done—a job which makes a better farm and helps to ensure permanence to our way of life. The job of rehabilitation of such lands can therefore be done if the will to do it exists.

What is the cost of rehabilitation of land? If men are hired to perform the labor, the costs can be figured. If the farmer becomes so interested in the job that he lets his hay spoil while he practices silviculture with an axe, the costs can be figured. But, if he puts in labor for which he has no other immediate market, he has made an investment which, if it returns something later on, is a sound investment. There is no cost for labor so expended, but there is a very certain though perhaps deferred labor return. In commercial undertakings, dividends on capital stock are not items of cost; they are only subclassifications of the returns, if and when the returns are large enough to permit dividends. The risk of losing the capital stock itself is always present in commercial enterprises. Many a corporation has made much worse expenditures of its money and had less return than the farmer receives when he spends his labor in land rehabilitation. The cost of restoring land to productivity, if carried on as a seasonal farm activity, cannot be figured by the usual methods of imputing cash values to unmarketable products.

Now let us return to the problem of management of existing farm woodlands. Foresters are taught to think in terms of stumpage—the net value of the wood crop as it stands in the woods. Farm economy is made of sterner stuff. The way of life of the farmer, the rules of the game which he plays, contemplate no such easy way as selling a crop as it stands in the field. The rule of the farm is, as far as possible, to process the product on the farm and to transport it to market with the facilities of the farm. With the possible exception of a few highly speculative agricultural adventures, such as citrus crops, the commodity sent to market acquires value largely through the work of men, animals, and machinery.

The farmer who sells his wheat or cotton or corn as it matures in the field, or rents his pasture to his neighbors, is not following the precepts of sound farm economy and is probably headed for the rocks. Very few banks or insurance companies find it profitable to operate or rent farm land acquired through mortgage foreclosures. Very few agricultural speculators, whether the crop is wheat or tung oil or citrus, realize the promised profits of the promoters. Agriculture by remote control must be classed as highly speculative. Farm economy, which in the long run succeeds in producing a satisfactory income, is based on the growing, the processing and transportation of the products of the land, and, in the vast majority of cases, the end result is the translation of labor into salable products. The better farmers, through planning, good business management, building up of soil structure and fertility, and some luck, are able to get more than a labor return, which is the margin from whence comes interest on capital invested, or rent for the landlord, and perhaps a profit.

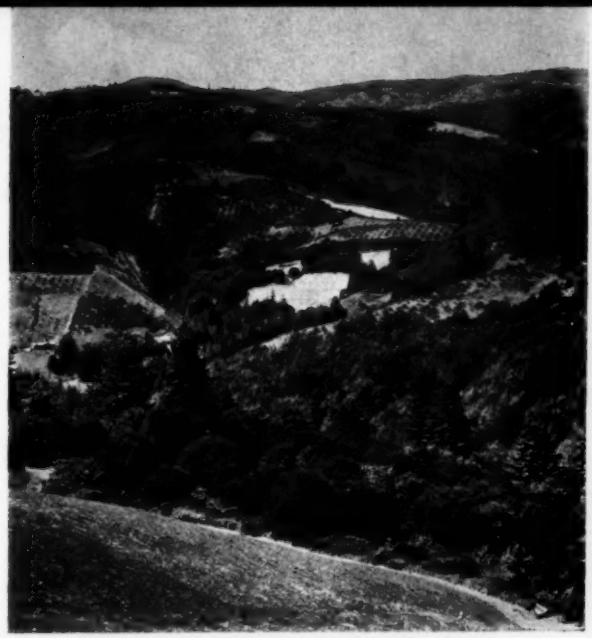
The "stumpage" of the forester has no place in farm economy, because the margin above cash costs is made up from all farm crops and the rubric of farm economy so ties all activities together that they are actually very difficult to separate. The fact that we still think in terms of stumpage only proves that the farm woodland is not being considered, or is not actually being operated, as a farm enterprise. The farmer plans his crops of corn, hay, wheat, with reference to the labor which he can put into them and with reference to the seasonal distribution of that labor. He plans to utilize nonscheduled time in mowing pastures, hauling and distributing fertilizer, building fences, clearing land, etc. If the farm woodland is actually included in his farm organization, he also plans his harvest of forest products with reference to his seasonal labor chart. The quantity of wood products removed is determined as much by his seasonal labor chart as it is by the market price of wood products or the calculated volume regulation of the forester. It may be good farm economy to cut less wood volume than the current growth even if the growing stock is nor-

mal, or it may also be wise to over cut temporarily in the woods with the expectation of either buying more acres of woods or of later diverting the woods labor into other farm enterprises.

One farmer, approached recently as a prospective cooperator on a farm forestry project, made a statement which showed clearly that his woods had never been incorporated into his farm organization. After expressing a willingness to have the forester examine his farm and his woods and see what forestry program could be worked out, he added these significant words, "But I am not going to give my timber away." When we examined his woodland, we knew what he meant. Part of his woods contained several hundred thousand feet of overmature, partly stag-headed timber. He has been waiting for probably 20 years to sell that timber to a logger and "cash in" on it. The price of logs or lumber in his neighborhood leaves no "stumpage" value. There is a labor return in it, however, if cut at the rate represented by his seasonal chart of available labor. If cut, skidded, and hauled to the mill in the winter with farm labor and equipment, the cash received would largely represent an actual increase in farm income with little additional expense.

If clean cut by a logger, as it would have to be, the cut-over area would become a fire hazard and very likely a "burn." The market for fuel could not absorb all of the tops and culls. If harvested annually over a period of 10 or 15 years, the logging waste could be sold as fuel, the fire hazard would be reduced to almost nothing, reproduction would be assured. Were this woodland actually considered as a part of the farm, farm economy would force its cutting even though no margin above the labor return was realized. The silviculturist would say that such a woods should be cut at once because losses exceed the growth, and it is therefore necessary that a young growing forest be substituted. From the standpoint of farm economy, however, all the arguments are in favor of a gradual removal of the crop. In this instance there was actually very little choice. This farmer could increase his farm income by taking the woodland into his farm business and cutting it as a farm crop. In the Big Hole Basin, in Montana, it used to be facetiously said that there were two seasons—haying and sleighing. This farmer could well recognize at least two important seasons in his farm calendar—haying and logging.

A farmer needs a variety of wood products, for his own farm business and to be in better position to take advantage of the varying demands of the wood market. Therefore, farm forestry should introduce on suitable sites new and promising, even exotic, species in mixture with the recognized standard species. If the



Farm planners consign to permanent woodland parts of the farm which vary all the way from eroded slopes and brush- covered wastes to good producing forests.

new ones grow and thrive, they will be favored; if they do not continue to show promise they will be removed in thinnings and no harm has been done. Thus farm forestry has a big advantage in this respect over agronomy or horticulture. For example, in western Oregon the farm woodlands are mostly Douglas fir, marketable for several products. There is a growing furniture market, based mostly on native alder and cottonwood of which some farmers have very little. It is good farm economy not only to increase the proportions of alder and cottonwood, but to introduce other trees, native or foreign, such as walnut, birch, maple, ash, beech.

Farm woodland management is a vastly different field from forest management. Farm planners in dealing with farm forestry problems should think in terms of farm economy as much as in terms of silviculture and forest regulation. Fuel wood in most farm woodlands is a byproduct and usually has a low value, a labor return only. Our objective should be to produce products which promise a margin above labor returns and take posts and fuel as byproducts.

At this stage in the development of the farm woodland as one of the farm enterprises, success depends largely on, first, a thorough understanding of how the farm woodland fits into farm economy and, second, on the ability of the farm planner to convince the farmer that he should change his concept of the farming business to include farm woods management as an integral part of it. This is a large order; but on it success in a farm conservation program largely depends.

USE OF BRUSH FOR EROSION CONTROL

BY R. E. WILSON [1]

EVERY farmer, rancher, lumberman, and forester agrees that where a limb or the branched top of a tree, or an old log, or the rusty flywheel of an old car is lying on the ground, the grasses or weeds grow a little thicker or taller as they come up through the branchlets, or along the edges of the board, or underneath the round of the log, or up through the hole in the flywheel. Why is this? It is because moisture is increased and retained after rains by any obstruction and protection on the ground. The same protection affects the plant temperature, whether it be heat or shaded coolness. Such an obstacle collects seed; and likewise it guards against the enemies of washing water and grazing animals.

If we extend this idea the results will gain in importance. It is told of many an old pioneer settler from back East, or Mormon farmer, that when he came to the new land he scattered a handful or so of tree seeds, flower seeds, or willow cuttings. It was said that he was introducing new species. Today we can attain a similar end by scattering a little brush here and there to aid in bringing back or increasing the plant cover on small worn areas that have been unwisely used over the years.

First, let us look at the business of procuring the brush. Softwood or evergreen brush, as a rule, is the best to use. In the Southwest, there is more of it (juniper, piñon, and pine) than of hardwood species. Oak or other broadleaved brush is also useful, especially to protect tree plantings; but coniferous brush provides a thicker body because of the needles, twigs, and larger stems, and by nature of its shape it lies closer to the ground where the first run of silt covers the needles and branch tips if tops are laid upstream or upslope. Conifer brush, particularly juniper, is more durable.

Brush from trees used to be cut in any manner, without thought as to whether or not the tree stands were injured. A tree was butchered or slashed and left in a more or less ruined condition, the main objective being to secure enough brush by the easiest method. Then, for stand improvement, the lower limbs of the trunk were pruned out. Thinning of a stand of trees and pruning still have their place in conservation, and the brush taken in the process is certainly to be used. Where the tree crown can be opened up by the cutting of certain branches, and leaving the lower limbs to protect the ground from water or wind erosion, no harm results from such pruning. Proper pruning of trees and shrubs on range lands, combined with proper grazing control, affords additional benefits in the form of renewed grass cover and shade on certain soil types and slopes. Good sod and a thick grass cover provide the best possible protection against erosion. However, since any diminution of the tree foliage decreases proportionally the leaf surface, so essential to tree life and growth, and since any lessening of the tree crown may open a path to water or wind action, it may be safely said that too much cutting may be harmful, and the less cutting done the better.

Just as the lumberman is adopting what is called "selective logging" and is cutting more conservatively and thinly over a larger area, thus leaving the forest in condition for a later cut, so is the farmer adopting a method of selective brush cutting in his woodland. The fundamental principle may be stated thus: Thin or trim as conservatively as possible, picking around for the brush so as to spread the cutting among more trees, but cut no more than one-sixth to one-fourth of the crown from any tree. In this way, only that brush is cut which should be cut—old limbs or those from tree sections that are too thick—and the full size of the crown as a windbreak remains undiminished while at the same time light is let into the foliage as in orchard pruning. Probably the tool most useful is the pole pruning saw which enables a worker to cut above his head or to reach into a dense crown such as that of cedar and juniper. Also, if workers are not practiced in good axmanship, the saw is a safer tool and not so tiring after the breaking-in period.

Now that the methods of securing brush have been explained, we turn our attention to where and how to use it, and this of course depends on the amount and type of erosion present. Brush should be used only in the smaller gullies at the heads of small drainages or in abandoned roads where the amount of run-off will not be too great. On farm and grazing land, erosion can be attacked where it starts, and that is the place to begin. At the heads of incipient rills and gullies, a light layer or mat of brush will start grass in the depressions, and extending such a layer on down stream or down the slope helps to keep the force and volume of water down to a degree where vegetation can survive and can compete successfully against erosion.

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Sooner or later the waterflow will increase to where a layer of brush alone will not withstand flood, and then it must be weighted with rock, or check damming must be resorted to.

Whether or not a continuous lining or layer of brush is better than intermittent or alternate lengths of brush and bare channel is a question still open to experiment. Since the role of the brush is to stimulate vegetative growth as well as to check and retard the waterflow, it seems that the continuous cover, no heavier than necessary, is to be preferred, with checks, or an increased amount, at intervals to help in lessening the velocity. This should permit establishment of a continuous grass cover the length of the waterflow. Today some of the waterflows that were treated with intermittent brush checks and mats show the spaces between still as bare as they were 3 or 4 years ago when the work was done, and the brush is still so thick in the checks that there is no growth whatever. This is open to question, however, as the increased cost and amount of brush available must be considered. The same idea in treatment applies to contour brush percolators on the range which often are built as high windrows that actually kill out vegetation for some period or which may be kicked out by cattle. Were even and thinner applications of brush used, two or three times the area of ground could be covered by the same amount, and in the end more grass would become well established.

The proper use of brush is all a very simple matter and, as someone wisely said, it is something every farmer can do. The only cash outlay is the price of a good pruning saw. Best of all, from the standpoint of our increasingly important farm forestry program, it is a type of work which gives employment in the slack season.

TIMBER AND CUT-OVER LAND PROBLEMS IN THE PACIFIC NORTHWEST

BY J. H. CHRIST [1]

BETTER land use through farmer marketing organization is unique as a major goal of the Forest Products Cooperative Association of the State of Washington. This new Pacific Northwest "farm co-op" is pioneering in an unusual but promising direction in a seemingly already crowded group-marketing field. Snohomish County, Wash., is noted for its partiality to this form of putting its products on the market. Ninety percent of its dairy products, for example, move from the farm through co-ops, as do 80 to 85 percent of its poultry and 60 to 65 percent of its berries and tree fruits. The forest products association, however, is the first to be set up west of the Mississippi River for handling this particular "crop." Although a handful of timber product cooperatives exist on the eastern side of the continent, the Washington State association is believed to be the first anywhere to base its membership on sustained-yield harvesting of the timber it markets and to call upon the Soil Conservation Service to give its members technical guidance in management of their woodlands and harvesting of their timber crops. The novel venture already is attracting wide and favorable attention the length of the Pacific Coast, among both loggers and mill men. They believe that cooperative marketing of timber products grown and harvested according to conservation rules is practicable.

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For a number of years, small farmers in Snohomish and other western Washington and Oregon counties have felt themselves to be handicapped in getting top prices on a market stiffened by big timber company competition, unless they cut their timber land clear for quick sale in quantity. Such cutting means lower per-cord profits, exhaustion of their timber and conversion of their farms into just so much more cut-over land. Even though the average farmer in this county, for example, has not more than 100 acres of timber—largely good second-growth fir and hemlock, black cottonwood, and some cedar, maple and alder in the untilled bottoms—and cannot go in for large-scale logging methods profitably, farm timber comprises a substantial portion of the remaining timber in the coastal area.

Thus the 1935 agricultural census showed that woodlands on Washington farms occupy a larger area than does wheat, with approximately one-fourth of the privately owned forest land and a tenth of the total forest area classified as farm woodland, including woodland pastures. It disclosed that a third of the State's farm families benefit from the sale of forest products, and that 9.2 percent of all Washington farms reporting in 1934 sold an average of $86 worth of such products.

The question was how to realize on this farm timber land profitably and safely. This was the problem the Soil Conservation Service foresters ran into at the

outset when the Snohomish C. C. C. Camp was established in 1938. The conservation practices that were demonstrated in cooperation with operators in the camp area followed the general pattern of streambank control in the narrow valleys to stop costly erosion in high-priced bottomlands, and of sustained-yield cutting, timber stand improvement, planting and other woodland management practices on the hill land to protect the watersheds.

The last-mentioned work in particular caught the eye of farmers such as M. C. James of Granite Falls, a former Ohio county extension agent, who already was talking cooperative marketing of his own and his neighbors' pulpwood, cedar poles, and other forest products. Regional Forester C. Svendby and Camp Forester William A. Tinney also thought there should be some way of turning the idea and the practices into a workable concrete plan, but knew that it could not be accomplished overnight. A visit to the Snohomish area in 1939 by John F. Preston, chief of the woodland management division of the Soil Conservation Service, and discussions at that time with Mr. James and the Region-9 Service foresters, helped in giving the idea a more tangible form.

Less than a year later, Mr. James and forty-four other Snohomish County farmers organized the forest products association, as a nonprofit, noncapital stock corporation aimed at "cooperative marketing, for eliminating speculation and waste and foi stabilizing forest products markets, and the maintenance of the maximum production capacity of the forest land." It now has its charter from the Washington Secretary of State and is losing no time in getting down to business under direction of its seven-man board of directors of which Mr. James is president. Manager Lester Sims, of Sultan, was appointed even before organization was completed, and County Agent A. Z. Smith is an unofficial but definitely active adviser in organizing detail.

Some of the charter members are experienced loggers and relatively large-scale operators, and others are dairy or general diversified farmers with small timber acreages. All are agreed on two points: That they can market better products at higher prices with the help of the co-op, and that they can depend upon their timber to provide dependable income for many years to come if they handle their woodland properly.

Every association member agrees to observe sustained-yield cutting methods, both on the 5 acres or more of timber owned at the time of joining the co-op and on any acquired later. The latter stipulation voted by the board before the association undertook its campaign for an extensive membership, is looked upon by forestry authorities as a most significant forward step in the recognition of sound forestry land use in a region still blessed with large and valuable timber stands. The potential possibilities also are reflected in the fact that the association, at first organized at Everett as a Snohomish County set-up, soon was broadened to its present status, with a view toward making it possible for farmers in other western Washington counties with similar problems to organize their own farm forestry cooperatives.

The Soil Conservation Service, for its part, is committed to cooperate to the extent of its available personnel and other facilities with the association members on lands on which they as Service cooperators practice sustained-yield harvesting of their forest products. Figures on the potential volume of forest products business, by the 50 or so charter members alone, give an idea of the task. The best available estimates place the total Snohomish County farm woodland at between 75,000 and 80,000 acres, some of the second-growth timber running up to 30 inches in diameter. The organizers control around 5,000 growing acres, about 4,000 acres of which is workable and the other thousand expected to be within 15 or 20 years. Preliminary surveys by Service foresters indicate that they should be able to market in the neighborhood of 4,000 cords of fir, hemlock, and cottonwood pulpwood a year. Douglas fir pulpwood has a market here. On the basis of the organizing membership, other products include up to a thousand cedar poles a year depending on the number of farmers cutting them and on the market condition, fence posts some hardwood of alder and maple, fuel products, tie timber in the log and hewed, shingle bolts, and cascara bark and fern. The gross marketing on this basis is figured at between $30,000 and $35,000 a year. Increased co-op membership will bring the totals up proportionately.

The Service plans to extend technical aid to the co-op growers by giving information on soils best suited to timber production, by guiding the farmers in meeting timber product specifications, predicting their yields, making physical inventories of the woods, giving advice on cutting methods in line with the sustained-yield objectives of the association and on new plantings by members, giving help in deciding on the proper products to be made from the timber for the greatest return to the grower, and by giving advice when asked on actual logging management practices.

The association expects to benefit its members in various ways. Foremost, of course, is the expectation of receiving better prices through pooled quantity

Typical streambank control. Live brush-mat riprapping as placed with the aid of the Snohomish, Wash., C. C. C. camp along streams that have been cutting valuable bottomlands and endangering the economic units of which timber on bordering uplands is a part.

marketing of timber products for which the co-op board may set up grade rules and which the grower agrees to deliver as directed in good marketable condition. He may sell for direct consumption by neighbors, or he may have certain products specifically exempted from his blanket marketing agreement. The "habit" of sustained yield and related sound forestry practice will be of continuing benefit to the members, for whom the association may make rules on the manner of harvesting and handling as well as on amounts to be sold.

A long list of forest products, aside from the regular timber "staples," already has been compiled by Manager Sims, and an effort will be made to assist members in finding markets for them, from peeled logs to Christmas trees. The association may be able, also, to make tractor power available to growers not in a position to provide themselves independently with such facilities for getting out what Mr. James termed their "little dabs" of timber products.

Better fire protection through group action has been studied, as have the problems of more effective utilization of information from the State Forestry department, passing along to members any advantages in work, and other benefits to be derived from such organization. One important subject now being considered is the possibility of using the association's influence to secure stricter State laws against theft of cascara bark and other timber products in the woods.

Finally, the buyers are able to reap their own benefits from the new organization, through more orderly and dependable marketing of small farm products, marketing of only those timber products that measure up to their standards and grade requirements, and so on. At the outset, the association interviewed every buyer but one between Bellingham and Tacoma to sound out the reaction to the new co-op marketing idea. The plan was received with unanimous favor by pulp mill, furniture factory, veneer plant and every other timber products user. Buyers liked the prospect of being able to reduce their bookkeeping and other costs by not having to handle the little amounts separately. The association has stated clearly that it has no intention of holding up prices, but expects only to undertake to sell its members' products at the "best prices obtainable under existing marketing conditions."

The forestry co-op organizers are neither theorists nor immature experimenters. The directors include men in their eighties, whose fingers are curved to ax and saw handles and calloused to splinters. I recall one board meeting not long ago when these men worked from 8 p. m. until well after midnight, drove home—some of them more than 20 miles—and nearly every one was found on the job in his timber the next morning. Each member pays his $2.50 membership fee; thus the association will be financed with a reserve fund built up from not to exceed 5 percent of the net returns in any fiscal year, drawing 3-percent interest for the grower. Cost of handling is deducted, of course, at the time of marketing.

The six regularly elected directors are all farmers who know the measure of a tree. Richard Roesiger of Lake Roesiger is vice-president, and other directors are R. G. Brooks of Hartford, John Spada of Snohomish, who is also master of the Snohomish County Pomona Grange, H. S. Ofstie of Monroe, and W. R. Millard

(Continued on p. 164)

SELF-GOVERNING PRINCIPLES OF SOIL CONSERVATION DISTRICTS

BY MELVILLE H. COHEE [1]

THE expression "soil conservation district philosophy" is often heard or used when Soil Conservation Service and other Federal and State agency personnel are discussing the rapidly advancing work of these districts throughout the country. It is unusual for anyone to challenge the premise that there is a districts philosophy; but on the other hand it is not always apparent that those who use the expression fully appreciate its significance, or that they conduct their day-by-day work in relation to soil conservation districts in such a way as to demonstrate their understanding of it.

It is questionable whether or not a satisfactory definition can be formulated for "districts philosophy" in the sense of clear and concise dictionary terms. Yet there are certain basic principles underlying the district, and beginning with provisions of a State soil conservation district law, which, if correctly appreciated and followed, will provide in the composite a true districts philosophy. The word "philosophy" may be considered, for purposes of this article, to mean a body of principles underlying this particular major discipline or organizational activity, namely, soil conservation districts. Those principles, comprising the soil conservation district philosophy, must be fully appreciated by all concerned if the districts movement is to be carried forward in the most satisfactory and expeditious manner.

Obviously, the most logical and ethical key to correct thinking with respect to any particular district is the State law under which that district was organized. Furthermore, from a study of any one of the 38 State soil conservation districts laws, it is easy to appreciate the general democratic procedure and self-governing principles involved in the creation, organization, and operation of a soil conservation district. The democratic process is the heart of the whole district philosophy.

The basic principles pertinent to the soil conservation district philosophy are threefold. First, it is clear that soil conservation districts are local units of government organized under State laws and answerable to the State legislatures. They operate in most instances over naturally bounded areas and come into existence only in response to the petition and favorable referendum vote of the land owners and operators carrying on agricultural operations within their boundaries. In this way, the necessary basis has been laid for the maximum exercise of initiative and responsibility by the farmers themselves.

Second, through the diligent efforts of most of the 38 State legislatures, the districts are equipped with a broad range of governmental powers—powers which are necessary if the districts are to perform their functions with efficiency. It may be said in general that the districts are authorized to do everything that needs to be done to achieve "the prevention and control of soil erosion and the conservation of soil and soil resources."[2] More particularly, the districts are authorized to carry out erosion control and soil conservation measures of all types—engineering operations, changes in methods of cultivation, the growing of vegetation, and changes in land use—on all lands within the district, whether public or privately owned. They may give assistance to farmers in preparing intensive conservation plans for their lands and in putting those plans into effect, through technical guidance and supervision, the loan of field equipment and the loan or gift of seeds and seedlings and of construction and other types of materials. They may act as land-management agencies by acquiring lands through purchase or lease and by administering those lands in any way that will advance their objectives. They may administer erosion control and soil conservation projects and activities, whether undertaken by themselves or by Federal or State agencies and entrusted to their care. They may, by referendum,

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[2] With no exception, all soil conservation districts laws either include the exact words quoted or words meaning the same.

adopt land use regulations in the public interest and enforce such regulations uniformly on all lands within their boundaries.[3] While the districts are limited to working in the field of "erosion control and soil conservation," that field is a very broad one in agriculture; and, generally speaking, soil conservation can be achieved effectively only if all lands are put to their proper use. Any essential undertakings to that end are plainly within the legal province of the districts.

Third, and a fact that is an obvious conclusion from the foregoing, it should be understood that soil conservation districts are "action" agencies and not merely "planning" agencies. To be sure, any action agency, in the interest of carrying on its work effectively, must make plans; to that end all soil conservation districts now in operation have first formulated some type of district-wide plan. It is equally clear, however, that the work of districts does not stop with the formulation of a plan; it includes also the direct effectuation of that plan through action on the land.

The conditions placed on assistance to districts are important to operation of the underlying principles. For many good reasons, the soil conservation districts laws have not empowered the districts with the taxing powers. Thus, for resources with which to operate their programs the districts are dependent for the most part upon State appropriations, which to date usually have been small or none at all, and assistance from Federal and local agencies. However, domination of soil conservation districts by cooperating agencies must be guarded against if the district movement is to develop along the most healthy and satisfactory lines.

Since it is not to be expected that assistance from public or private agencies to a soil conservation district will be in the form of outright, unconditional grants, the arrangements surrounding such assistance are of utmost importance to the future of the district movement. Owners and operators of land lying within the boundaries of a soil conservation district to an appreciable degree understand in their own way the real district philosophy. They cherish the democratic-procedure principle. They will defend their rights to civil liberties. They want to be self-governed. They appreciate the desirability of a local unit of government established for the specific purpose of controlling erosion and conserving the soil resources. But, generally speaking, they also need and want help toward putting a farm or ranch conservation plan into operation on their respective farms and ranches. It is entirely possible and probable, therefore, that the governing bodies of soil conservation districts, as well as owners and operators of lands therein, are vulnerable to all kinds of arrangements and procedures which are not in keeping with the democratic essence of the true district philosophy. This is possible since these men are frequently inclined to overlook some of the basic principles essential to the long-time development and success of the district because of their immediate desire to obtain material assistance.

It therefore is not unreasonable to charge every public agency and every private citizen assisting soil conservation districts with the responsibility of protecting and assisting in the proper development of the district movement. When such agencies and individuals thoroughly understand the underlying principles of the district approach in soil conservation and erosion control, they should have little difficulty in discharging this responsibility. But if districts are treated without regard to their potential position in the field of land-use adjustment, that is, as autonomous agencies—even though at the outset the inexperienced district officials may lack initiative, administrative ability, and the background necessary to exercise their responsibilities in the best way—the fault for the failure of districts to stand on their own feet and solve their own problems will rest squarely on the local, State and Federal cooperating agencies.

Many public agencies may assist the districts. The Soil Conservation Service is not the only agency that can and should play an important part in furthering the correct appreciation of the soil conservation district philosophy, even though to date it has been very active in assisting districts. Several agencies can be named, including the State extension services, Federal Forest Service, State departments of vocational education, Bureau of Agricultural Economics, State conservation commissions or State forestry departments, Farm Security Administration, State agricultural experiment stations, Agricultural Adjustment Administration, local county boards or commissioners, Farm Credit Administration, and others. Certain desirable propositions may be considered by the Soil Conservation Service in assisting soil conservation districts, if it is to make its greatest contribution to their proper development. These desirable propositions are discussed in the following numbered paragraphs:

1. The entire personnel of an assisting agency must thoroughly understand the underlying principles of the soil conservation district. It should be appreciated that Soil Conservation Service personnel, and personnel of many other agencies assisting the districts either at the present or in the future, were accustomed, before the advent of the districts, to carrying out

[3] Six States—Vermont, Minnesota, Iowa, Idaho, New York, and Nebraska—have not granted to farmers the authority for enacting or enforcing land-use ordinances.

programs directly rather than by giving assistance to another agency. Thus, to some extent, it is to be expected that personnel, in many instances, finding the circumstances changed, will consider themselves as among those who appreciate the districts philosophy and yet unwittingly will conduct themselves in such a way as to ignore almost totally the cardinal principles necessary for the success of the district movement.

2. Those directly interested in soil conservation districts must realize the need for widespread appreciation of the correct district philosophy, and they must also develop ways and means of bringing about this appreciation. This responsibility rests heavily on those agencies making substantial assistance available to districts, and upon the governing bodies of the districts. In any new development similar to the soil conservation district movement, it is essential that there be "sponsoring" agencies or individuals to carry along the movement until such time as it is old enough to proceed on the basis of its own experiences and momentum. In this instance, the governing bodies of soil conservation districts will soon gain experience and an appreciation of their responsibilities sufficient to make unnecessary any "guardianship" type of aid. Nevertheless, two State agencies—the extension service and the State soil conservation committee—and one Federal agency, the Soil Conservation Service, should feel an especially heavy responsibility in this regard.

3. All branches of assisting agencies must realize that the organization of soil conservation districts is the responsibility of local farmers and ranchmen and respective State soil conservation committees, and not of any Federal agency. This, however, should not prevent representatives of Federal agencies or any other interested agency from advising and consulting with either farmers and ranchmen or the State soil conservation committee, regarding organization of districts.

4. Assisting agencies must recognize that district governing bodies are responsible for development of the districts and, therefore, outside assistance to such districts should be made available in such a manner as to provide fully for an appreciation of the responsibility of the district and its governing body. In view of the fact that soil conservation districts are new, and that sufficient time in all cases has not elapsed for district governing bodies to become thoroughly conversant with their responsibilities and the best methods for exercising them, it is particularly urgent that representatives of assisting agencies be alert to the fact that by acting too freely for the district they may jeopardize the proper development of initiative on the part of the members of the governing body.

5. All procedures formulated and followed by any agency in making its assistance available to soil conservation districts should be in keeping with the underlying principles; procedures should not be such as to make it impossible for representatives of the assisting agencies to recognize the proper prerogatives of the districts they may be helping. If the Chiefs and assistant heads of the various Federal and State agencies will continue to make special efforts in this direction, any confusion on the part of their subordinates concerning the proper role of an assisting agency in relation to a soil conservation district will be more readily eliminated.

Some Department of Agriculture interests are similar to those of soil conservation districts. As this is written, the Department of Agriculture is assisting 263 soil conservation districts, and memoranda of understanding between the Department and these districts, distributed over 30 States, are in effect. Departmental interest does not rest alone in the fact that these districts need technical guidance, equipment, materials, labor, and other assistance, which the Department is directed by the Congress to supply. It lies also in the fact that the objectives of good land use are common for both the districts and the Department. It is, among other reasons, because of this community of purpose that some departmental workers mistakenly contend that any program carried out by a district, in which a departmental agency is cooperating, should be a joint responsibility of the district and the departmental agency or agencies concerned. Work undertaken by a soil conservation district in its own right is truly the responsibility of that district, regardless of the type or amount of assistance that it may receive from any agency or individual.

A soil conservation district, as any other well-organized and efficiently operating unit of local government, needs plans for use in giving direction to its work. Moreover, agencies of the State or of the Federal government can best decide whether or not to assist a soil conservation district if they first know the proposed course of action which the district chooses to follow in reaching its objectives. Thus, as might be expected, in each memorandum of understanding thus far negotiated between a soil conservation district and the Department of Agriculture, it is provided that the district will prepare a program and a work plan.

The district philosophy manifests itself in practical programs, plans, and operations. A soil conservation district program is the district governing body's statement of erosion conditions, soil conservation problems and their causes, and the major accomplish-

ments which the district hopes to attain in the solution of such problems. The program is essentially an educational and informational document describing agricultural conditions, problems, and objectives. Once formulated, it is a source of most of the facts and information used by the district in carrying on its educational and informational work. In many instances, the district program has been widely circulated in order to acquaint farmers and others interested in agricultural problems with a background of the facts establishing the reasons for, and the objectives of the district. In short, the soil conservation district program provides the answer as to why soil conservation and erosion control activities are essential and gives a general picture of the accomplishments which the district hopes to realize.

The soil conservation district work plan, on the other hand, is a presentation of the specific conservation practices and methods proposed for application on lands within the district, the current plan of district activities and procedures for carrying on such activities, and the possible sources of assistance that may be utilized by the district. It is commonly said that the district work plan provides a statement regarding what is to be done, and where, when, how, and by whom. To be effective the district work plan must be dynamic rather than static—revised continually and progressively for improvement on the basis of additional information, experience, and newly developed objectives.

As might be expected, a review of many of the soil conservation district programs and work plans that have been prepared to date reveals that they were compiled in various and sundry ways and contain a wide variety of context and scope of statements. Some contain statements explaining exactly how they were prepared. Even without such statements, it is obvious that many were prepared entirely by assisting agencies and that the governing bodies offered their main contribution through their signatures. From a review of other programs and work plans it is easy to conclude, without question, that the members of the governing body, with the assistance of land owners and operators and representatives of local, State, and Federal agencies, have really carried out the job themselves. Obviously, the latter course is more desirable if the soil conservation district philosophy is to become a reality in operation.

When public agencies are called upon to assist the district in this work, their representatives can do much to show their real understanding of the purpose and principles surrounding the district if, in each step of the preparation of the two district documents, they encourage the district governing body to assume its responsibilities in fact and not by approbation alone. In this respect, it is noteworthy that recently more and more district governing bodies not only have been assuming this important responsibility but have actually eliminated superfluous suggestions heretofore included in some programs and work plans. The assumption of this responsibility is not primarily a result of experience on the part of the governing bodies, for obviously the governing body of a soil conservation district organized this month has less experience than that of a district created two years ago. The gratifying fact is that representatives of assisting agencies—the State soil conservation committees, the State extension services, the Federal Soil Conservation Service and others—are more and more appreciating the fact that it is possible to help a soil conservation district governing body without doing all the work.

Appropriateness of operation on the part of assisting agencies, with respect to districts and appreciation of the district philosophy, is by no means limited to preparation of the district program and work plan. In fact, that is a more or less minor part compared to the entire cooperation between an agency and a district over a period of years. Another consideration of far-reaching consequence is that pertaining to the conditions established by an assisting agency surrounding its help made available to a district for the purpose of carrying on district work. To illustrate this point, the form for cooperative agreement used between the district and the land owners and operators and covering farm conservation plans may be cited.

The Soil Conservation Service, through the memorandum of understanding establishing relations between it and a district, is given the prerogative to find satisfactory or unsatisfactory the form for cooperative agreement adopted by the district to cover farm or ranch conservation plans in cases where the district through personnel of the Service assigned to it provides assistance in their preparation and execution. The point here is not whether there should be a cooperative agreement, or if it should include consideration of all parts of a farm or ranch; and neither is it whether or not the Service should be given such a responsibility as a condition to extending assistance to a district. Rather, it is how the Service should perform with respect to this particular "condition" on its assistance to the district. As a matter of fact, in order to expedite district work at the outset some three years ago, the Service released to its field staffs a "suggested" form for cooperative agreement to be presented for consideration by the governing bodies of

districts. Obviously, the Service had certain basic provisions in mind for such a cooperative agreement form; otherwise, it could not have prepared a suggested form.

Perhaps, instead of a detailed form, the Service should have released to its field staffs merely a statement of the general fundamentals to be covered by provisions of a cooperative agreement. The district supervisors could then draft, in their own language, a form for a farmer-district cooperative agreement with the appreciation that it was their form, and that since it incorporated the basic principles required by the assisting agency (in this case, the Soil Conservation Service) it would likewise be satisfactory to that agency. Such a procedure would be in complete harmony with the district philosophy, and the principle underlying this suggested approach is one that might well be observed in other phases of cooperation between any agency and a soil conservation district.

At present, the primary attack of soil conservation districts toward their solution of erosion control and soil conservation problems is, first, by distribution of general and practical information to land owners and operators of lands lying within the district as to practices and methods of farming that will control erosion and facilitate soil conservation; and, second, by assisting farmers or ranchers in forming and applying individual farm and ranch conservation plans and work on district-owned or leased lands that will bring about the desired land use and soil conservation practices. For the most part this work actually is carried on by personnel from assisting agencies under the direction of the governing bodies of the districts and in keeping with district made plans. Upon request, and as available resources permit, Soil Conservation Service personnel are assigned to districts for the purpose of assisting in the preparation of individual farm conservation plans and in other ways that help to further the purposes of the district—S. C. S.-C. C. C. camp labor, with facilitating personnel, materials and equipment, affords a source of real assistance to districts.

The farm conservation plans formulated by the landowners and operators with aid of personnel available to the district, as referred to above, are covered by cooperative agreements. In view of the manner of approach which most soil conservation districts are following today in carrying out their work, it is readily apparent that personnel from the Service, and all other agencies cooperating with a district, are in strategic positions with reference to their conduct regarding the fundamental principles underlying a conservation district and the success or failure of a district as such.

Quite properly, the Service does not guarantee that the farm conservation plan which its personnel assists in formulating will completely control erosion on a farm. The determination of the degree to which the plan will be effective in erosion control—as an indication of the desirability of the supervisors signing an agreement with the farmer covering the plan—is a proper responsibility of the governing body of the district and of the land owners and operators involved. Service personnel have the responsibility of presenting all facts and all alternatives in the situation to the governing body and allowing it to decide from knowledge of local conditions and circumstances whether or not such a plan accomplishes a sufficient objective to be a worth-while endeavor. By and large, experience seems to indicate that if a plan of conservation operations is acceptable to the district governing body—where it has a complete knowledge of facts in the case—such a plan would also provide for practical soil conservation undertakings and thereby would be acceptable to the Service. The Service should not establish arbitrary standards for farm conservation plans which are acceptable to it but which may not represent the desires of the district or the farmers. The Service has the responsibility of so informing the district governing body that it may have a complete understanding of the elements of good farm conservation plans and that it may make decisions as to acceptability on an equitable basis. The farm planner—assigned to a district by an assisting agency—who has a problem of recommending what to do with the so-called "submarginal" or "uneconomic" unit should be guided in a major degree by the judgments of well-informed members of the governing body of the district after they have all the facts pertaining to the case.

This approach can be used just as effectively as an alternative method used prior to the advent of soil conservation districts whereby the Service personnel and the land owners and operators involved assumed full responsibility for the correctness and completeness of farm conservation plans. At the same time, such conjecture as to the right way to work with a district does not mean that the Service is obligated to continue assisting a district even where the governing body either lacks information concerning farm conservation plans or for some reason does not establish standards high enough to warrant expenditures of public resources. It is not counter to the district philosophy, as I conceive it, that any agency assisting a district should establish standards governing its assistance whereby the resources at the command of

(Continued on p. 164)

NEW CONSERVATION PRACTICES REPLACE THE OLD IN THE PEACH ORCHARD

BY JOHN T. BREGGER [1]

INTENSIVE cultivation has been for many years the traditional culture for peach growing. On the long, sloping sites normally chosen in order to secure good air drainage, the natural result of such a practice is erosion—usually extensive erosion. If ever there was an agricultural industry with practices favoring erosion and land abandonment, it is to be found in many peach districts of the United States. The situation is a serious one and it should be faced before conditions become more acute.

A clear understanding as to why and how intensive cultivation in peach orchards is so harmful should help greatly in solving the erosion problem. In general there are three reasons, the first of which is that most peach orchards in the country were square planted without any attempt to run the straight rows across the slope even where it was possible. This means invariably that the cultivation, in either direction, must be more or less up and down hill. Furthermore, the cultivation season is long and continuous; usually cultivation is practiced without let-up from blossom-time until harvest, all through the season of high-intensity rains in the humid sections of our country. To make matters even worse, peach orchards invariably are clean cultivated—whether or not there are weeds or other vegetation to be destroyed—and the result is that at times more soil moisture is released by evaporation than is conserved by the creation of a dust mulch. Whether intentional or otherwise the objective of a great deal of peach orchard cultivation has been to destroy completely or to cover up every last bit of living or dead vegetation on the soil.

Naturally not all peach growers are playing the part of the "horrible example." Some of them, like the corn growers of the Middle West and elsewhere, already have learned that excessive cultivation long since reached the point of diminishing returns; that it rarely pays beyond the point of correcting the actual competition of weeds and other vegetation for a supply of moisture or soil nutrients not present in sufficient quantity for both at any given time. The turning back from overcultivation which was made so easy by our modern farm machinery, has not been too general among peach growers chiefly because of the significant lack of factual data on which successful curtailment of cultivation can be based. In the attempt of the few to find the answer to this question, the problem is being solved to some extent without the aid of the experiment stations, and it is hoped that a survey and evaluation of these "trial and error" grower experiences may be of use to those who need this information.

A knee-high stand of Austrian winter peas used as a cover crop in a South Carolina peach orchard.

The peach tree is more sensitive to privations brought on by competition with other plants than the apple and some other tree fruits, and for this reason cultivation has seemed necessary for optimum growth of both peach trees and fruit. Closer examination reveals, however, that there are certain critical times when a peach tree needs ample supplies of moisture and nitrogen both of which may be appropriated by competing vegetation. One of the most critical times is in early spring when the trees are not only blooming or setting fruit, but making new wood growth with an abundance of foliage. At this time of year, moisture is usually present in abundance while soluble nutrients in the soil are much more limited. This stage of fast growth, accompanied by rapid fruit enlargement, is followed by a period wherein there is less growth and almost no fruit enlargement. Then, during the month or so preceding harvest, the final fruit swell takes place, and during this period the tree demands an abundance of soil moisture but much less of the nitrates and other nutrients.

Orchard cultivation methods as used by growers in an attempt to meet these conditions frequently have "overshot the mark." In the first place, cultivation has served the necessary purpose of providing soil aeration in early spring to a greater extent than it has provided for the purpose of moisture conservation. The demand for sufficient soil nitrogen usually can be supplied more economically through fertilization than

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by operations to speed up the breaking down of the soil humus and the orchard cover crop. Again, during the pit-hardening period when moisture demands are not ordinarily great, clean cultivation usually is not necessary. Throughout the more critical final growth period of the peach, however, there can be serious competition for moisture from tall-growing and deep-rooted vegetation, but here again clean cultivation may not be necessary. Mowing has been successfully substituted for any kind of cultivation under such conditions; or, a type of cultivation may be employed which significantly reduces the transpiration rate of the cover crop without exposing the soil to possible erosion.

The distinction between deep- and shallow-rooted cover crops should be considered, especially when mowing, or some method of curtailing top growth is to be omitted during critical periods of low rainfall or moisture shortage. With a shallow-rooted cover crop on a "deep" soil where peach trees are deep-rooted, the effect of the cover crop can be ignored as far as the trees are concerned. Under such conditions, the trees have access to the only existing moisture reserve, and the cover crop either dies or wilts and becomes practically dormant. An important distinction must be made at this point in that young peach trees do not have a sufficient number of roots at these lower depths and therefore cannot survive the competition of other vegetation during the growing season. Even with young trees, however, cultivation can be confined to a strip or circle adjacent to the trees so that plenty of vegetation is left in the row middles for the complete, or at least adequate, control of erosion.

The type of cultivation probably has more to do with its harmful and beneficial effects than any other single factor. I have already referred several times to "clean" cultivation as a very common cause of promoting serious erosion; until recent years no other kind was given much thought unless one considers the opposite of clean cultivation often described as the "poor" or "careless" job. Today we intentionally practice "trashy" or "duckfoot" cultivation; this means not so much a partial job of cultivation as a method designed to leave cover crop residues, in whole or in part, on the soil surface instead of turning them completely under so that they will decay immediately. Farm machinery ranging from the single shovel "sweep" to the wider weed eradicator, and even the ordinary disk harrow, may be used to bring about the desired condition.

Next to clean cultivation, the most variable, if not ineffective, practice which has become associated with commercial peach growing is use of the so-called winter cover crop. Ordinarily planted too late and at the driest period of the year, it rarely makes sufficient growth to control fall and winter erosion. In other words, it is not a "winter cover crop" at all, but a spring cover crop. What is sometimes even more surprising is the fact that peach growers often will destroy a good protective cover of volunteer crabgrass and other weeds—or perhaps a summer cover crop—only to replace it with a poor cover of the planted crop. From the standpoint of both soil conservation and economy this is unfortunate for the peach growers, particularly when they plant an expensive crop such as winter vetch. Even rye and ryegrass must be planted early in the fall to allow stooling out and to make a satisfactory ground cover.

Already peach growers themselves have pointed the way in the direction of conservation practices that will control erosion and at the same time allow optimum fruit production. This is especially true when the question of orchard longevity, an important factor in total yields and income, is considered. The trends as outlined in the following paragraphs (1, 2, and 3) are indicative of the progress being made by growers toward the practical conservation methods possible even in square planted orchards:

1. *Permanent vegetation.*—The complete elimination of cultivation may seem an impossible and impractical way of controlling erosion in the peach orchard without curtailment of quantity or quality of production. Yet various peach growers in Pennsylvania, Michigan, Arkansas, Kentucky, and Tennessee have done this very thing. A typical example is the orchard of Herman Yopp near Paducah, Ky., which has been in annual lespedeza sod for about 8 years. Not only has the former state of erosion been eliminated but tree growth and production have been maintained at a high level. Another example of this same practice is to be found in the orchards of the Arkansas Orchards Co. near Nashville, Ark., where peach trees actually regained their lost vigor under a 7-year treatment of lespedeza cover with a slight increase in the nitrogen application. A peach orchard at the Tennessee Experiment Station has received no cultivation for approximately 10 years, and here it was found by actual experimentation that additional nitrogen is necessary under these conditions. This was important, as formerly it had been taken for granted that a moisture shortage rather than a nitrogen shortage was the chief limiting factor under a continuous cover. Recent studies by the author in South Carolina indicate that although moisture may be depleted to a certain extent

in the topsoil, bearing peach trees having access to subsoil moisture below the 2-foot level do not suffer from moisture shortage because of the presence of a shallow-rooted cover crop such as Kobe lespedeza. When deeper-rooted cover crops are used, frequent mowing may be advisable.

2. *Strip vegetation.*—Next to a complete cover, we may have a continuous vegetative cover which is broken into strips instead of being solid. This is in more or less common usage, but still in a vast minority as far as general commercial practice is concerned. A good example of a peach orchard under partial grass sod is to be found at Clemson College, S. C. Bermuda grass has been allowed to occupy about one-half the total ground area, being located in the contour tree rows while the middles receive two or three cultivations per year. Crabgrass is allowed to grow following the cultivation period, and usually a winter cover crop of rye is planted in the fall. In spite of the Bermuda grass sod, however, this orchard has borne large crops of high quality fruit along with a vigorous tree growth.

Another type of strip cultivation is exemplified by the experience of Ed Miller, near Romney, W. Va., who has practiced alternate row cultivation in a bearing peach orchard for many years and in his opinion has maintained as good yields and fruit size as on adjacent blocks where all middles are cultivated. Erosion has been controlled remarkably well on a rather steep slope by these alternate strips of continuous sod; erosion control is of course the main justification for the practice in square planted orchards. Under contour planting it would be even more effective and could be utilized for the increase of soil organic matter by alternating the vegetation and cultivation every few years and combining with a winter cover crop in the cultivated middles.

3. *The winter cover crop.*—It has been stated that the main limitation of a winter cover crop has been its lateness or slowness of growth in the fall. To overcome this situation, Purcell McCue, a leading peach grower of Albermarle County, Va., plants his rye cover immediately following peach harvest, the last week of August or early in September. By the time cold weather curtails its growth his rye is well stooled out and covers the ground like a carpet. Ryegrass also will make a compact cover when planted in early fall and will give good winter protection. On the other hand, soil protection may be secured without a heavy growth of winter cover crop if volunteer crabgrass and weed growth is left on the soil surface as mulch. P. S. Wade, commercial peach grower of Cornelia, Ga., plants his winter cover crop of rye and winter peas by a trashy cultivation that provides adequate protection even though the planted cover crop does not make its growth until spring. An additional advantage of this trashy cultivation, as practiced by Mr. Wade, shows up in the high level of organic matter found in the soil of his 28-year-old peach orchard. It has been found that crimson clover may be sown without cultivation by taking advantage of the firm seedbed and crabgrass residue already there to provide for better germination and growth, especially in the fall when dry weather is most likely to occur in many peach districts.

Trashy cultivation of rye cover crop (right), in contrast to usual cultivation of vetch cover crop (left).

A new type of cover cropping appears to show promise under peach orchard conditions. This practice is practically new as far as its adaptation to commerical plantings is concerned, but is theoretically sound. If, instead of relying on a fall-planted winter cover crop for soil protection and organic matter additions, a summer-planted crop of a suitable legume-nonlegume mixture is planted during the summer, a good soil cover can be obtained. Soybeans or cowpeas mixed with Sudan grass makes an especially good combination which can be mowed during dry weather or just before peach harvest. Even though these plants are killed by winter freezing, the ground cover—essentially an anchored mulch—is a good protection against run-off and erosion, and a significant amount of valuable organic material is added to the topsoil in the spring.

Although the foregoing discussion has been confined to vegetative types of conservation orchard practices,

(*Continued on p. 164*)

SELF-GOVERNING PRINCIPLES OF SOIL CONSERVATION DISTRICTS

(Continued from p. 160)

that agency are to be expended in an efficient way.

There are countless additional phases of soil conservation district organization, and analyses of assistance from agencies to a district, which could be reviewed to point toward establishment of the premise that there is a district philosophy and that it can be furthered or constricted by those assisting agencies.

Further dissertation on details seems unnecessary and would not alter the conclusion that an appreciation of the district philosophy should guide all interested persons toward the objective of satisfactory operation of districts. To be sure, sometimes what appears at the moment to be a violation of such a philosophy may in reality be a necessary expedient to further its real end; but it is the gross violations and permanent trends away from the principles germane to the real "districts way of operation" that must be avoided at all cost. Oftentimes the personnel of assisting agencies become impatient with the new approach through districts, would much prefer to discontinue relations with them, and would rather work directly with land owners and operators even though the total amount of conservation on the land would not be as great if the latter course were followed. This feeling of impatience is truly commendable provided such personnel lend their efforts toward encouraging and assisting the governing body of the district to equip itself to carry on its work; but it is a dangerous tendency when the personnel, because of natural human tendencies to operate directly purport only to further the district as such and actually carry on their daily duties much as if the district did not exist.

When it is considered that the first soil conservation districts law was not established in any State until 1937, that since that time nearly a quarter of a billion acres of land have been included within districts and, further, that districts are for the most part really running their own affairs, then there need be no genuine apprehension that the movement will not succeed. On the other hand, national crises, changes in points of view of representatives of assisting agencies, confusion or jealousies between agencies assisting districts, and any number of related considerations, may tend to disrupt or circumvent the true district philosophy and bring the death of this new and worthy democratic soil conservation movement. The soil conservation district approach to a widespread attack on the devastating forces of soil erosion and soil destruction is not without precedent in other countries; but its degree of success in the American way will be unmatched and unprecedented if allowed to continue along present trends and especially if it continues according to the real underlying principles which in their entirety constitute a distinct philosophy.

TIMBER AND CUT-OVER LAND PROBLEMS

(Continued from p. 155)

of Granite Falls. The seventh board member, appointed by the State director of agriculture to represent the public, is Prof. Bror L. Grondall of the University of Washington School of Forestry at Seattle.

President James himself has summed up the co-op's plans and goals effectively:

"The main thing was to make a start," he said. "If we can get things on a good working basis and prove to our members that we can be of service, in 4 or 5 years we may have five or six cooperatives in different counties. The average farmer knows very little about forests and forest products. For that reason, chiefly, we have organized and put ourselves in a position to make use of service available from foresters and soils men. Marketing troubles are particularly bad when the product isn't sought; that is, when the big grower has trouble, the little grower hasn't a chance at all. The buyers are beginning to have to go back farther and farther for their poles and certain other products; we should be able to help them to supply their demands from nearby lands.

"As soon as a farmer begins to cash in on his forest, he will appreciate its worth. The main thing, then, is to find markets for his products. We need to appreciate the fact that forestry is not a hindrance to cultivation farming; it will be a help and will complement regular farming. I believe in the advantages of sustained yield, and that the forestry people can carry their point a lot farther through this association that talks sustained yield and backs them up."

PRACTICES IN PEACH ORCHARD

(Continued from p. 163)

it should be stated emphatically that in most instances these practices should be accompanied by contour planting and terracing as the fundamental basis for successful operation. Concentration of run-off under any but the most ideal conditions will tax most agronomic practices adapted to peach orchards beyond their normal effectiveness. Only through a combination of all phases of a coordinated erosion-control program shall we accomplish our ultimate objective in a practical manner.